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(54) **An oro-nasal mask**

(57) A multi-faceted oro-nasal mask comprises multiple, triangular, essentially flat panels - which enables it to be folded until required for use and, when opened, creates a geodesic structure whose edges afford rigidity while the intermediate "flat" surfaces are suited to manufacture from either porous, filter material or impermeable membranes for the incorporation of hose connections, gas flow regulation or direction control valves as required by specific applications. The mask may comprise skeletal frames or permeable membranes for use with replaceable filters or be incorporated in a head which is transparent in part or as a whole.

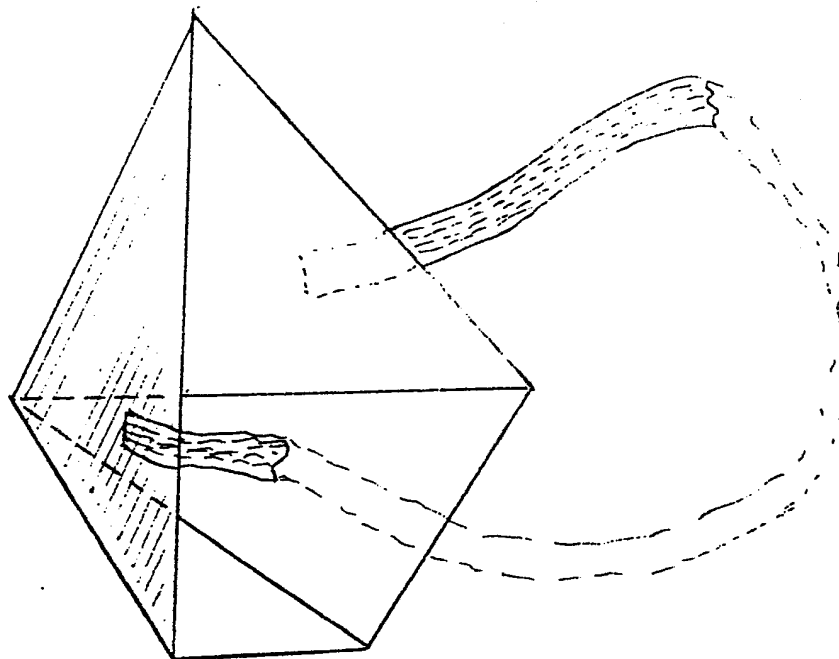


Fig 2

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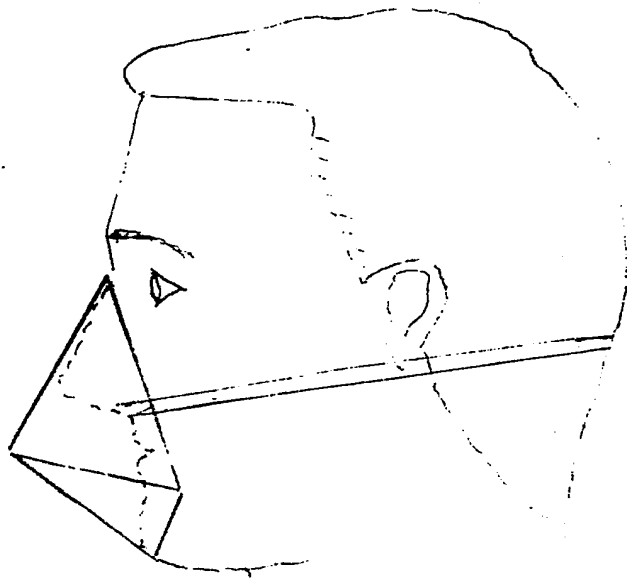


Fig 1

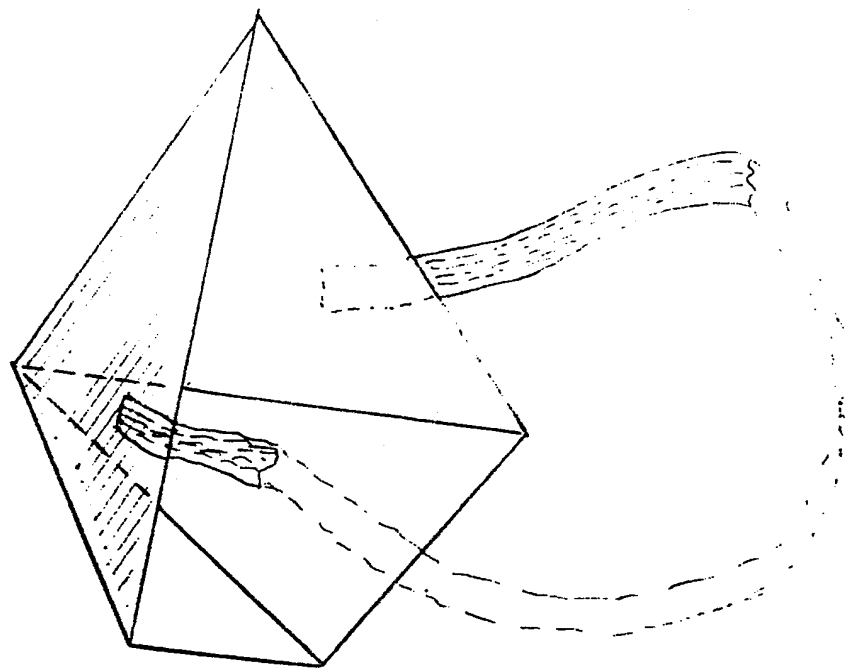


Fig 2

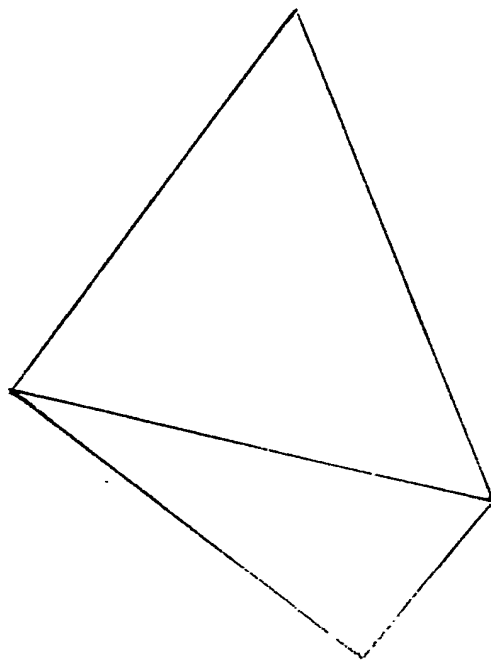


Fig 3

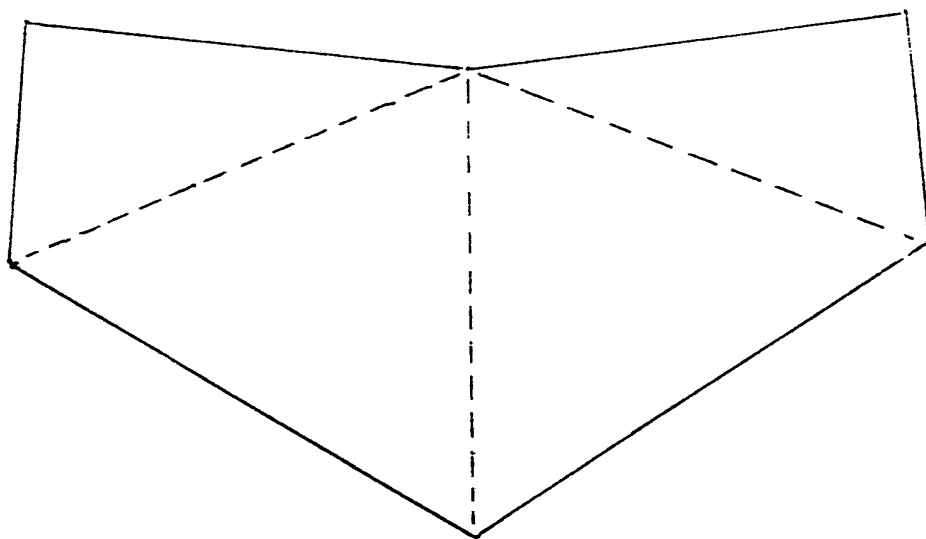


Fig 4

SAFE-T-BEEK - AN ORI-NASAL ENCLOSURE

This invention relates to an ori-nasal enclosure; the chosen name - BEEK - is both descriptive (in its likeness to a beak) and its relevance to Breathing Equipment of Every Kind.

5 Such enclosures are well known to those skilled in the art of breathing equipment as means of delivering breathable gases to the nose and mouth of a wearer and of removing expired gases.

10 The novelty of this particular invention is in its construction - of multiple, triangular, essentially flat panels - which enables it to be folded until required for use and, when opened, creates a geodesic structure whose edges afford rigidity while the intermediate "flat" surfaces are suited to manufacture from either porous, filter material or impermeable membranes for the incorporation of hose connections, gas flow regulation or direction control valves etc, as required by specific applications.

15 Potential applications of such equipment are too numerous to list in total so that any use mentioned here is cited by way of example only, it is neither exhaustive nor exclusive of other uses. Among the applications foreseen are:-

- 20 Nuisance dust masks (disposable and re-usable)
- Industrial safety masks
- Surgical anaesthetic masks
- Aircraft passenger oxygen masks
- Therapeutic oxygen masks
- Fire escape filter masks
- 25 Combined fire protective and oxygen masks for aircraft
- Passengers
- Toxic gas protection masks for industry
- Police force gas masks

Military NBC protective equipment  
Closed circuit breathing apparatus  
Open circuit breathing apparatus  
Underwater use

Choice of materials for construction determine whether the product is disposable, or re-usable, protective at normal or elevated temperatures.

Figure 1 shows the ori-nasal enclosure in use. Figure 2 shows in perspective a typical variant of the enclosure open, ready for use. Figure 3 shows an enclosure folded for storage.

BEEK is formed from a number of essentially flat, triangular panels of rigid or semi-rigid material which are so constructed or joined together to fold along their adjacent edges. The material used may be impermeable or porous or of filtering property according to application. By way of example four such panels are shown developed in Figure 4, folded flat in Figure 3 and separated at their unattached edges to form a multi-faceted cup in Figure 2. In this illustration 4 facets create the enclosure which, by virtue of its triangulated shape, can support significant external loads, while the remaining 2 open, adjacent facets form the opening for insertion of the nose and mouth. The number of facets may be varied to meet needs of individual applications, to facilitate incorporation of the enclosure into more complex breathing apparatus or to enhance wearer comfort.

In certain applications the structural panels may be reduced to skeletal form to serve as support frame for a light, flexible filter material. The whole is attached to the face of the wearer by means of an elasticated or otherwise adjustable head band or harness.

The basic panel structure alternatively enables attachment or incorporation of other respiratory system components to admit:-

60 1. The addition of oxygen or other breathable gas (such as an anaesthetic) to the delivered or filtered air. This has relevance to medicine and aviation.

65 2. The addition of an inflatable or other gas reservoir to enable constant delivery of the supplementary gas with minimal wastage during non-inspirational periods, as an alternative to the provision of a demand regulator.

3. The incorporation of one-way valves to ensure unidirectional flow of breathable gases.

4. The attachment of hose means as part of an external supply and/or recirculatory breathing system.

70 5. The attachment of alternative filter means in the form of cartridge(s) or canister(s) both with and without one-way valves.

75 6. The attachment of enlarged fabric filter means in the form of extended side panels. In this case certain panels of the enclosure must be permeable. In accord with the requirements of the specific application flow may be unidirectional or reversible according to the incorporation of one-way valves.

7. The attachment of a transparent visor to any of the above forms to provide a protective covering for all or part of the face.

80 8. The incorporation of any of the above enclosure and breathing system means into a hood or envelope which may be transparent in part or as a whole so as to afford total head protection.

BEEK variants can be combined if required: for example the additional filter of Variant 6 can incorporate the economiser of Variant 2. In this way inflation of the economiser bag will serve to obstruct the filter and so ensure preferential inspiratory of the stored gas until this has been depleted. This is particularly relevant to survival in toxic or oxygen depleted atmospheres.

The BEEK configuration illustrated creates an external surface area adequate for use as a filter. For some applications, however, reduction of internal volume takes precedence. To meet this requirement Low Volume (LV) BEEK proportions have been determined. Dimensions of all variants are adaptable to optimise fit for a range of facial characteristics but the design is such that a compound seal to the face is obtained. The compound seal so formed derives in part from edge contact (or rim contact) and in part from tangential contact with the skin of the wearer. Relative ratio of rim to tangent contact will vary with size of BEEK and wearer but tangent contact normally predominates at the lower facial regions. Certain uses may require an exceptionally high performance seal; enhanced sealing is obtainable from the use of a secondary seal component or components attached to the rim of the open facets of the BEEK.

### CLAIMS

1. A multi-faceted ori-nasal enclosure constructed from essentially flat triangular panels of rigid or semi-rigid material which may itself possess filter qualities moulded or otherwise joined and hinged together so as to create a structure with an aperture for the insertion of the nose and/or mouth. This structure can (a) be reduced to geodesic or other skeletal form as support framework for an attached filter membrane or (b) act as attachment means for external filters, connecting means, one-way valves and/or breathable gas storage or source means so as to form part of open or closed circuit breathing apparatus.

The precise number of facets is determined by the needs of specific applications and certain exposed sharp corners of the triangular facets may be radiused to enhance comfort. Said enclosure means is equipped with an elasticated or otherwise adjustable headband or harness or other means of securing the enclosure to the face of the wearer. It has been shown that, according to the tension afforded by the harness means, the entire enclosure may release expired gases from its facial seal, in this way a uni-directional gas flow can be achieved without the need for additional expiry valves.

2. An ori-nasal enclosure as Claim 1 used in conjunction with a secondary seal means attached to the perimeter of the aperture.

3. An ori-nasal enclosure as Claim 1 or Claim 2 to which is attached a visor, transparent in part at least, for use as eye and face protection.



( 4. An ori-nasal enclosure as Claim 1 or Claim 2 incorporated into a hood, envelope or other means, transparent wholly or in part, to thus afford protection for the entire head. The head-attachment means of Claim 1 may be separate or incorporated into the fabric of the hood or envelope. The outward venting capability of Claim 1 may be utilised to ventilate the interior of the hood or envelope and effectively maintain it under an internal pressure raised above that of the outside atmosphere. In this way an associated neck seal is not required to meet a demanding performance specification.

30 5. An ori-nasal enclosure as Claim 1 or Claim 2 used in conjunction with open circuit or closed circuit breathing means and enclosed within a protective envelope to enclose the entire head.

Amendments to the claims  
have been filed as follows

1. A multi-faceted ori-nasal enclosure constructed from a number of essentially flat triangular panels, all of which have one common apex, of rigid or semi-rigid material which may itself possess filter qualities moulded or otherwise joined and hinged together so as to create a structure with an aperture for the insertion of the nose and/or mouth. This structure can (a) be reduced to geodesic or other skeletal form as support framework for an attached filter membrane or (b) act as attachment means for external filters, connecting means, one-way valves and/or breathable gas storage or source means so as to form part of open or closed circuit breathing apparatus.

The precise number of facets is determined by the needs of specific applications and certain exposed sharp corners of the triangular facets may be radiused to enhance comfort. Said enclosure means is equipped with an elasticated or otherwise adjustable headband or harness or other means of securing the enclosure to the face of the wearer. It has been shown that, according to the tension afforded by the harness means, the entire enclosure may release expired gases from its facial seal, in this way a uni-directional gas flow can be achieved without the need for additional expiry valves.

2. An ori-nasal enclosure as Claim 1 used in conjunction with a secondary seal means attached to the perimeter of the aperture.

3. An ori-nasal enclosure as Claim 1 or Claim 2 to which is attached a visor, transparent in part at least, for use as eye and face protection.

4. An ori-nasal enclosure as Claim 1 or Claim 2 incorporated into a hood, envelope or other means, transparent wholly or in part, to thus afford protection for the entire head. The head-attachment means of Claim 1 may be separate or incorporated into the fabric of the hood or envelope. The outward venting capability of Claim 1 may be utilised to ventilate the interior of the hood or envelope and effectively maintain it under an internal pressure raised above that of the outside atmosphere. In this way an associated neck seal is not required to meet a demanding performance specification.

5. An ori-nasal enclosure as Claim 1 or Claim 2 used in conjunction with open circuit or closed circuit breathing means and enclosed within a protective envelope to enclose the entire head.